

Claims

1. A workpiece transfer to load and unload workpieces for a decorating machine, said workpiece transfer including the combination of:

at least one workpiece gripper for supporting a workpiece during changing of the orientation thereof from a first orientation to a second orientation wherein a workpiece in said first orientation has a longitudinal central axis orientated in one of a vertical orientation and a horizontal orientation and in said second orientation has said longitudinal central axis in the other of said vertical orientation and horizontal orientation; and

a drive to rotate said workpiece gripper about a rotational axis forming acute angles with said longitudinal central axis of a workpiece in each of said vertical orientation and said horizontal orientation.

2. The workpiece transfer according to claim 1 further including a control including a pivot carried by said drive for pivoting said workpiece gripper to control receiving and delivery of a workpiece for each of said first orientation and said second orientation.

3. The workpiece transfer according to claim 2 wherein said control further includes an actuating rod slidably supported by said drive to pivot said workpiece gripper about said pivot in timed relation with rotation of said workpiece gripper about said rotational axis to orientate said workpiece gripper substantially vertical for travel to

5 support a workpiece in said vertical orientation and to orientate said workpiece gripper substantially horizontal for travel to support a workpiece in said horizontal orientation.

4. The workpiece transfer according to claim 3 wherein said control further includes a stationary cam having a cam track engaged with a cam follower supported by said actuating rod and movable along said cam track by said drive.

5. The workpiece transfer according to claim 2 wherein each of said acute angles is 45°.

6. The workpiece transfer according to claim 5 further including conveyors for transporting a workpiece with longitudinal central axis thereof orientated in each of said vertical orientation and said horizontal orientation, and wherein said control includes a cam for pivoting said at least one workpiece gripper in a timed relation with rotary motion of said workpiece gripper by said drive for continuous motion of a workpiece in a substantially matched speed and direction of conveyance of a workpiece by each of said conveyors.

7. The workpiece transfer according to claim 1 wherein said drive includes a driven drive shaft rotatable about an axis defining said rotational axis, a hub secured for rotation by said drive shaft, said least one workpiece gripper including a plurality of workpiece grippers pivotally supported at angularly spaced apart sited by said drive hub.

8. The workpiece transfer according to claim 1 wherein said at least one workpiece gripper includes a support arm joined by said pivot for rotation about said rotational axis forming acute angles, a mounting fixture joining said support arm to a

carriage containing spaced parallel rods each having grippers for supporting a workpiece
5 between the grippers of each rod, said longitudinal central axis of a workpiece when supported by said grippers forming an acute angle with a plane containing pivotal movement by said support arm.

9. The workpiece transfer according to claim 8 further including at least one member retaining one rod of said spaced parallel rods for pivotal movement of grippers supported thereby into and out of engagement with a workpiece, a resilient member for pivotally urging said one rod in a direction for supporting a workpiece by said grippers, a cam follower joined by a crank arm to said one rod, and cams including cam surfaces to engage with said cam follower for pivoting grippers of said one rod in a direction away from supporting engagement with a workpiece for receiving and delivering a workpiece in each of said first orientation and said second orientation.
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10. A workpiece transfer to load and unload workpieces for a decorating machine, said workpiece transfer including the combination of:

a plurality of workpiece grippers pivotally supported at angularly spaced apart sites by a drive hub for supporting the workpieces during changing of the orientation thereof from a first orientation to a second orientation wherein a workpiece in said first orientation has a longitudinal central axis orientated in one of a vertical orientation and a horizontal orientation and in said second orientation has a longitudinal central axis in the other of said vertical orientation and said horizontal orientation;

a drive secured to said drive hub for rotation of said workpiece grippers
10 about a rotational axis forming acute angles with the longitudinal central axis of a
workpiece in each of said vertical and horizontal orientations; and
control rods for pivotally displacing said grippers to control receiving and
delivery of workpieces when the longitudinal central axes thereof are at each of said first
orientation and said second orientation.

11. The workpiece transfer according to claim 10 wherein each of said
acute angles is 45°.

12. The workpiece transfer according to claim 11 further including
conveyors for transporting a workpiece with longitudinal central axis thereof orientated in
each of said vertical orientation and said horizontal orientation, and wherein said control
includes a cam for pivoting said at least one workpiece gripper in a timed relation with
5 rotary motion of said workpiece gripper by said drive for continuous motion of a
workpiece in a substantially matched speed and direction of conveyance of a workpiece
by each of said conveyors.

13. The workpiece transfer according to claim 10 wherein said control rods
further includes an actuating rod slidably supported by said drive to pivot said workpiece
gripper about said pivot in timed relation with rotation of said workpiece gripper about
said rotational axis to orientate said workpiece gripper substantially vertical for travel to
5 support a workpiece in said vertical orientation and to orientate said workpiece gripper
substantially horizontal for travel to support a workpiece in said horizontal orientation.

14. The workpiece transfer according to claim 13 wherein said control further includes a stationary cam having a cam track engaged with a cam follower supported by said actuating rod and movable along said cam track by said drive.

15. The workpiece transfer according to claim 10 wherein said plurality workpiece grippers each include a support arm joined by said pivot for rotation about said rotational axis forming acute angles, a mounting fixture joining said support arm to a carriage containing spaced parallel rods each having grippers for supporting a workpiece
5 between the grippers of each rod, said longitudinal central axis of a workpiece when supported by said grippers forming an acute angle with a plane containing pivotal movement by said support arm.

16. The workpiece transfer according to claim 15 further including at least one member retaining one rod of said spaced parallel rods for pivotal movement of grippers supported thereby into and out of engagement with a workpiece, a resilient member for pivotally urging said one rod in a direction for supporting a workpiece by
5 said grippers, a cam follower joined by a crank arm to said one rod, and cams including cam surfaces to engage with said cam follower for pivoting grippers of said one rod in a direction away from supporting engagement with a workpiece for receiving and delivering a workpiece in each of said first orientation and said second orientation.

17. A workpiece transfer including the combination of:
- a transport conveyor for carrying workpieces having an elongated longitudinal axis, said conveyor supporting each of said workpieces with said elongated longitudinal axis in a vertical orientation;
- 5 a decorator conveyor including spaced apart workpiece carriers to support a workpiece for rotation about the longitudinal axis of the workpiece in a horizontal orientation;
- 10 a plurality of workpiece grippers on a drive hub for supporting said workpieces during movement of the longitudinal axis thereof between said horizontal orientation and said vertical orientation;
- 15 a drive shaft secured to said drive hub to rotate about an axis forming acute angles with the longitudinal axis of a workpiece in each of said horizontal orientation and said vertical orientation;
- drive shaft pivots extending in a plane perpendicular to said axis about which said drive shaft rotates for pivotally connecting said plurality of workpiece grippers at angularly spaced apart sites to said drive hub; and
- control rods for pivotally displacing said workpiece grippers about said pivot thereof in a direction generally parallel with the axis about which said drive shaft rotates for controlling the delivery and reception orientations of workpieces with respect to said transport conveyor and said decorator conveyor.
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18. The workpiece transfer according to claim 17 wherein each of said acute angles is 45°.

19. The workpiece transfer according to claim 18 wherein said control rods engage a cam for pivoting said at least one workpiece gripper in a timed relation with rotary motion of said workpiece gripper by said drive shaft for continuous motion of a workpiece in a substantially matched speed and direction of conveyance of a workpiece
5 by said transport conveyor and said decorator conveyor.

20. The workpiece transfer according to claim 17 wherein said control rods further includes an actuating rod slidably supported by said drive to pivot said workpiece gripper about said pivot in timed relation with rotation of said workpiece gripper about said rotational axis to orientate said workpiece gripper substantially vertical for travel to support a workpiece in said vertical orientation and to orientate said workpiece gripper substantially horizontal for travel to support a workpiece in said horizontal orientation.
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21. The workpiece transfer according to claim 20 wherein said control further includes a stationary cam having a cam track engaged with a cam follower supported by said actuating rod and movable along said cam track by said drive.

22. The workpiece transfer according to claim 17 wherein said plurality of workpiece grippers each include a support arm joined by said pivot for rotation about said rotational axis forming acute angles, a mounting fixture joining said support arm to a carriage containing spaced parallel rods for supporting a workpiece between the grippers

5 of each rod, said longitudinal central axis of a workpiece when supported by said grippers forming an acute angle with a plane containing pivotal movement by said support arm.

23. The workpiece transfer according to claim 22 further including at least one member retaining one rod of said spaced parallel rods for pivotal movement of grippers supported thereby into and out of engagement with a workpiece, a resilient member for pivotally urging said one rod in a direction for supporting a workpiece by 5 said grippers, a cam follower joined by a crank arm to said one rod, and cams including cam surfaces to engage with said cam follower for pivoting grippers of said one rod in a direction away from supporting engagement with a workpiece for receiving and delivering a workpiece in each of said first orientation and said second orientation.

24. A method for loading and unloading workpieces for a decorating machine, said method including the steps of:

releasably gripping a workpiece for changing the orientation thereof from a first orientation to a second orientation wherein a workpiece in said first orientation has a 5 longitudinal central axis orientated in one of vertical or horizontal orientations and in said second orientation has a longitudinal central axis in the other of said vertical or horizontal orientation;

rotating the gripped workpiece about a rotational axis forming acute angles with said longitudinal central axis of a workpiece in each of said vertical and horizontal 10 orientations; and

pivottally displacing the gripped workpiece in a plane generally parallel with said rotational axis to control receiving and delivery of a workpiece as the longitudinal central axis thereof approaches each of said first orientation and said second orientation.

25. The method according to claim 24 wherein each of said acute angles is 45°.

26. The method according to claim 24 including the further steps of conveying workpieces with the longitudinal central axis thereof in each of said vertical and said horizontal orientations.

27. The method according to claim 24 including the further step of controlling rotation of a gripped workpiece by said step of rotating in timed relation with pivoting of the gripped workpiece by said step of pivottally displacing to orientate a workpiece substantially vertical for travel to support a workpiece in said vertical orientation and to orientate a workpiece substantially horizontal for travel to support a workpiece in said horizontal orientation.

28. The method according to claim 27 wherein said step of controlling further includes using a stationary cam track to impart said pivoting of the gripped workpiece for said step of pivottally displacing the gripped workpiece.

29. The method according to claim 24 including the further step of decorating a workpiece while rotated about said longitudinal central axis in a horizontal orientation and transferring a workpiece with said longitudinal central axis thereof in a vertical orientation before and after said step of decorating a workpiece.